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0008

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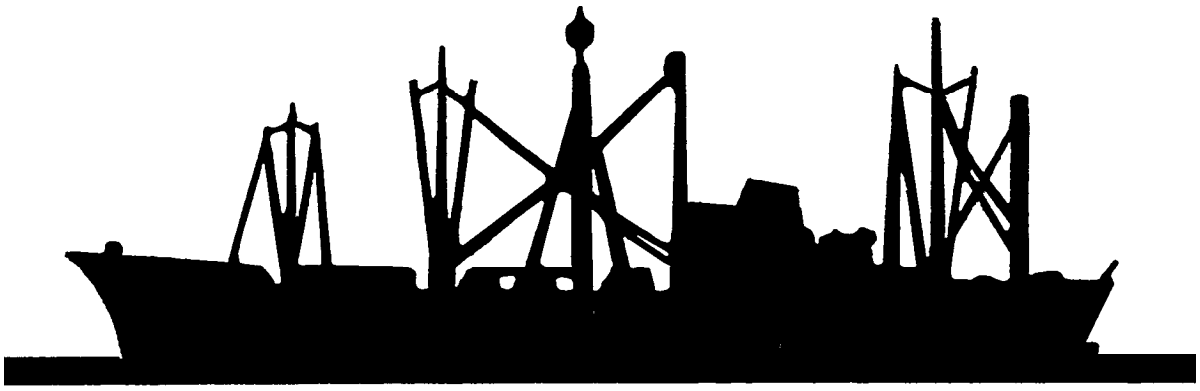

INSTITUTE FOR RESEARCH AND ENGINEERING FOR AUTOMATION AND PRODUCTIVITY IN SHIPBUILDING

IREAPS

PRODUCIBILITY FROM CONCEPTUAL DESIGN TO SHIP CONSTRUCTION

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Director
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ABSTRACT

Producibility concepts may be applied in a variety of ways. Three main classifications are identified:

1. At the conceptual design stage
2. At the design development stage
3. As a method of reducing operational costs by removing work content, shortening the construction time and rationalizing material requirements of existing designs.

This paper reviews the effectiveness and likely benefits to be gained from these three approaches and examines design engineering, production engineering, facilities engineering and personnel engineering as applied at these three levels.

Figure 1

COST CONTROL POTENTIAL

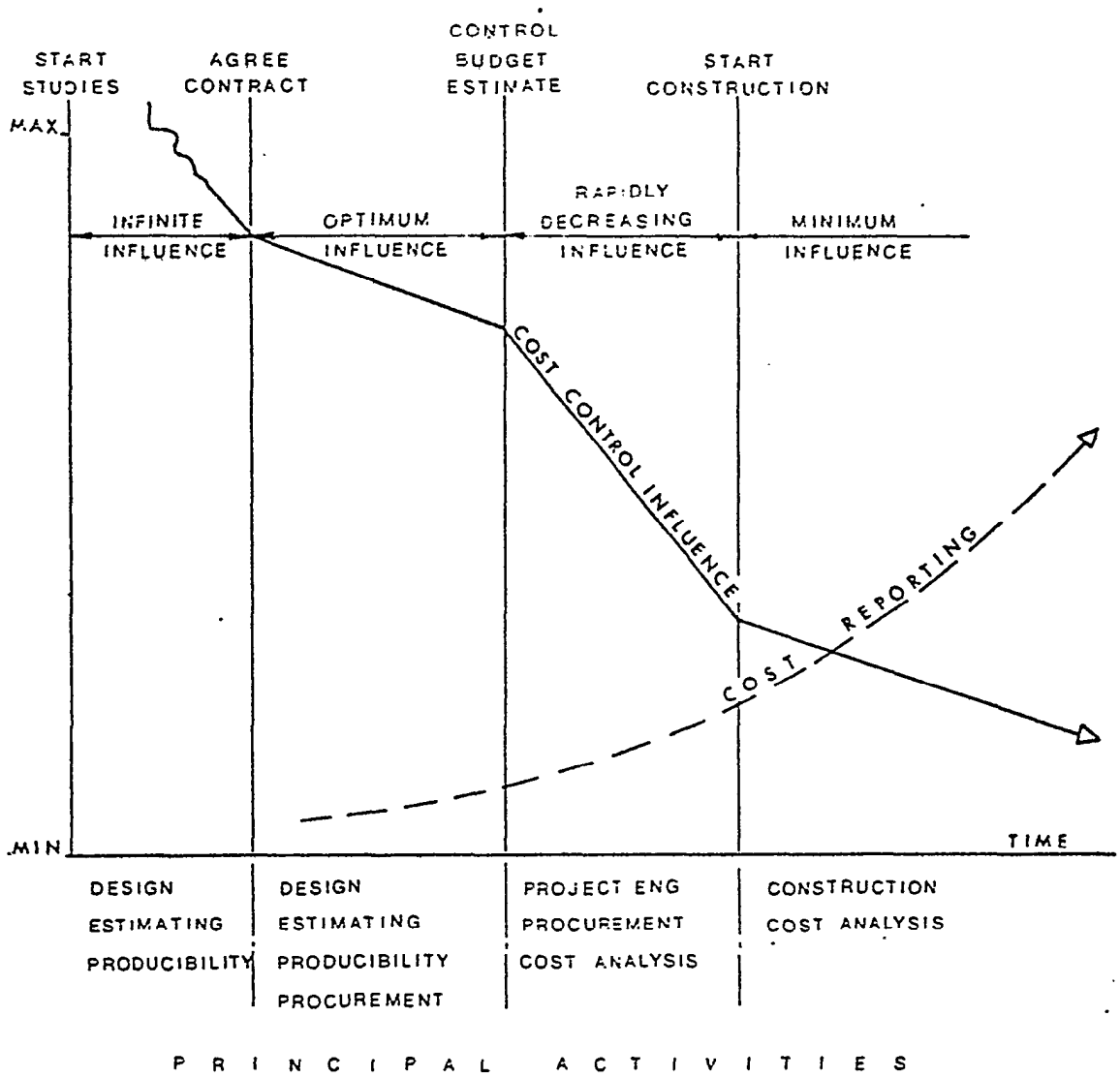
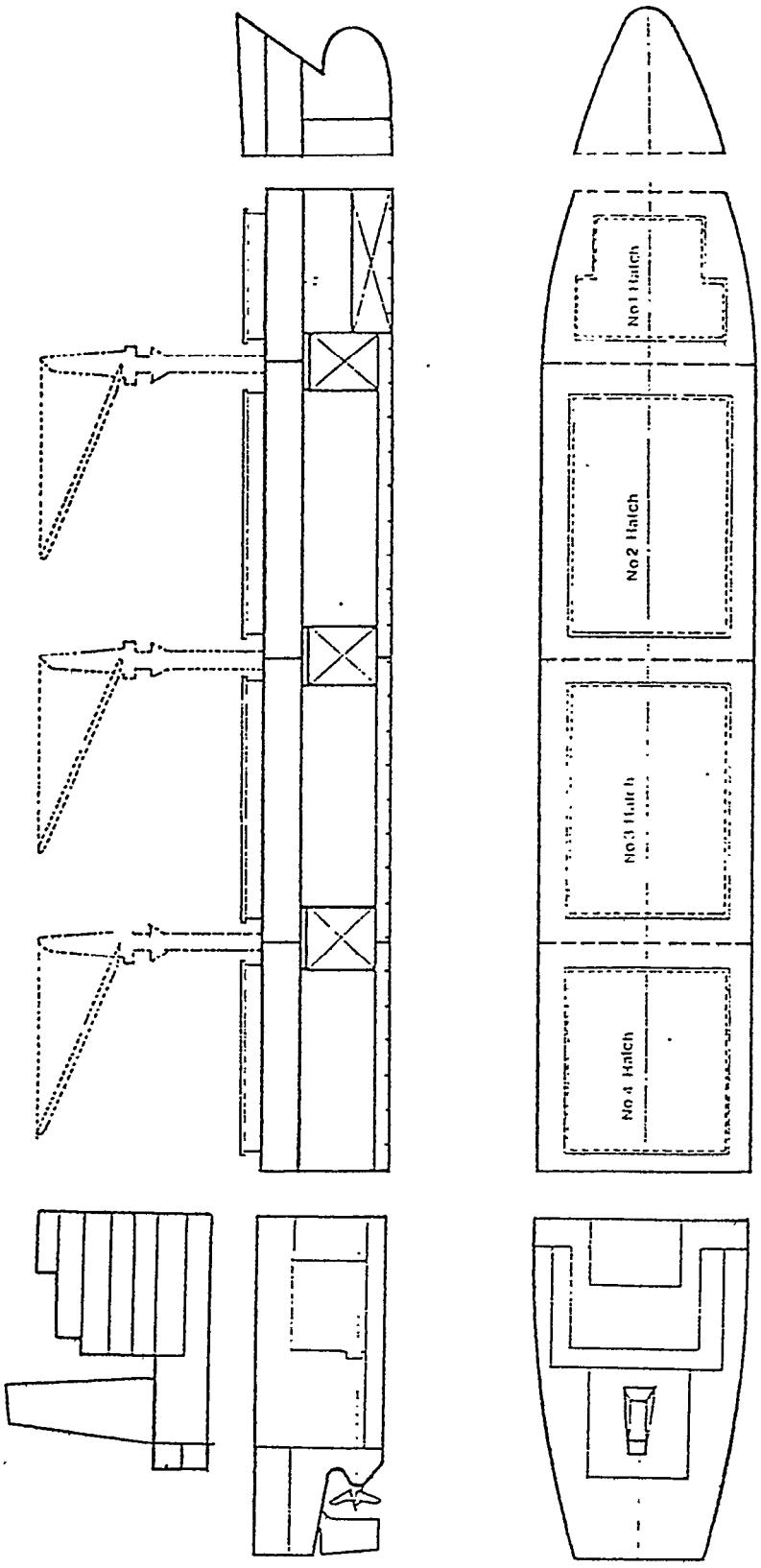
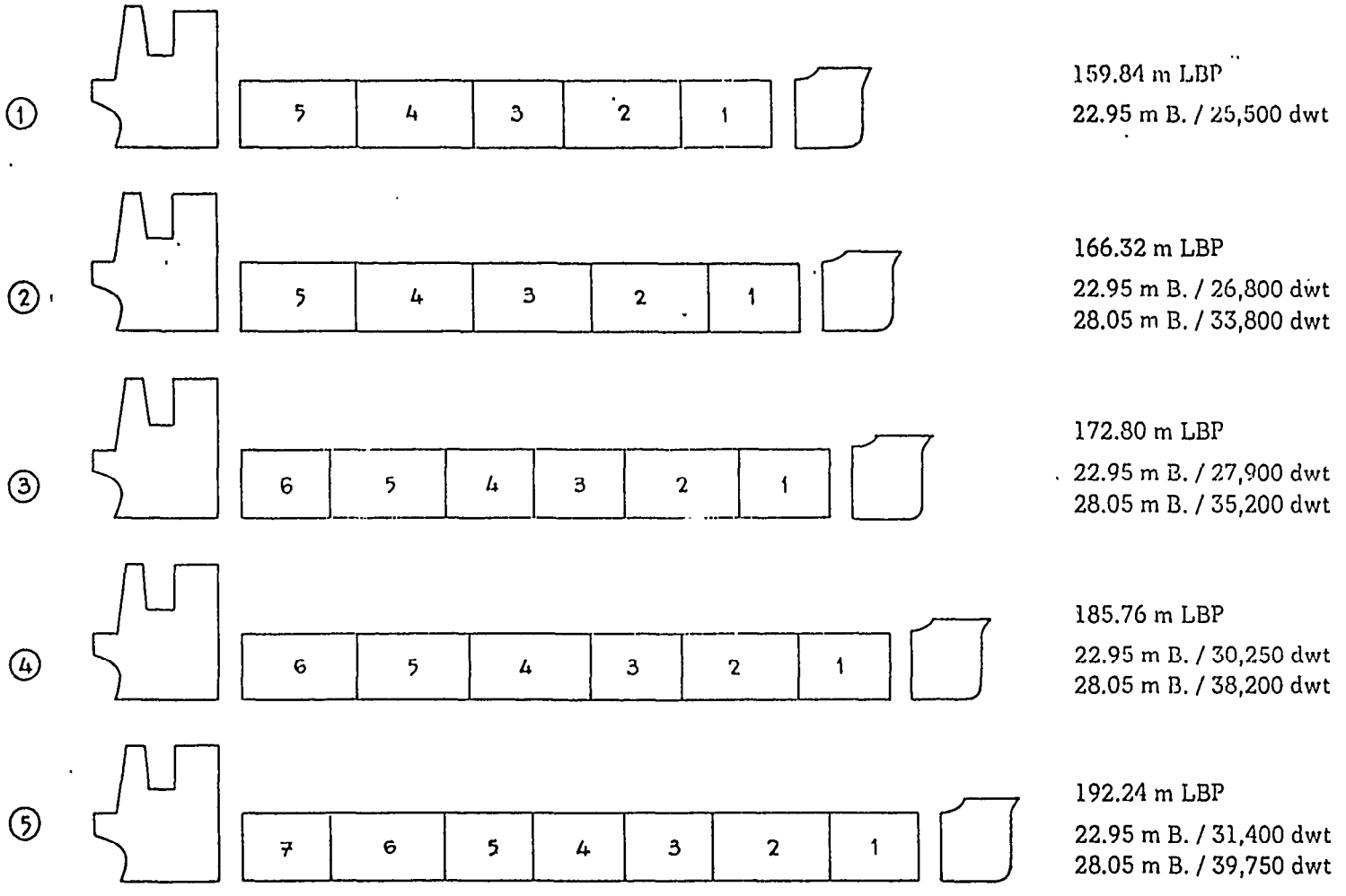


Figure 2

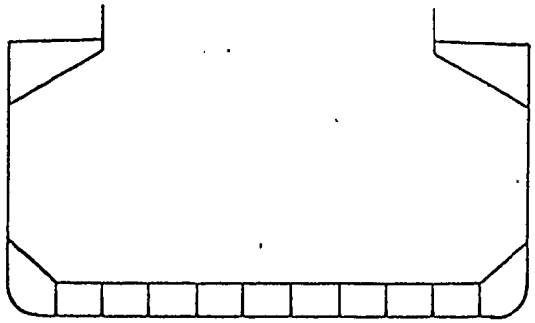




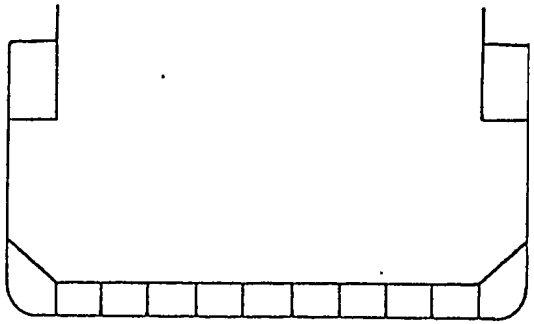
Length-Dead weight Options

Figure 3

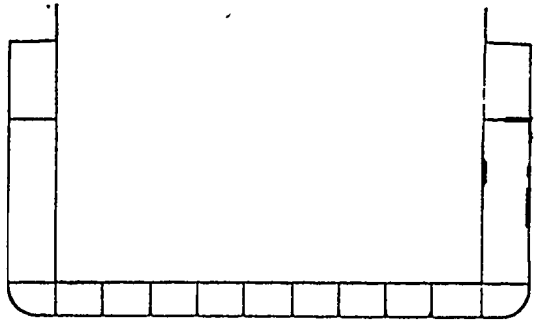
28.05 m B.Mld.



CONVENTIONAL

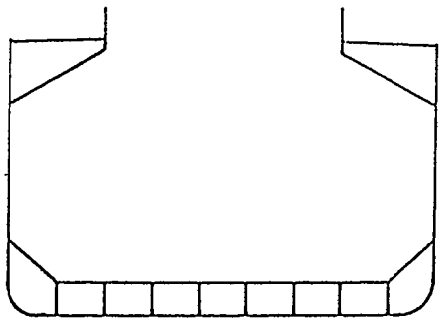


WIDE HATCH



FOREST PRODUCTS

22.95 m B.Mld.



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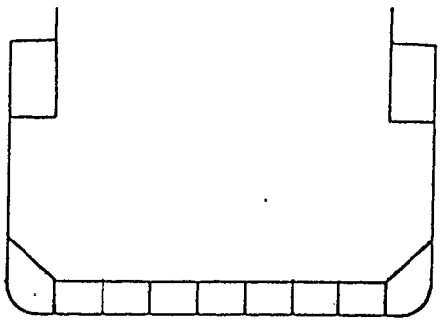

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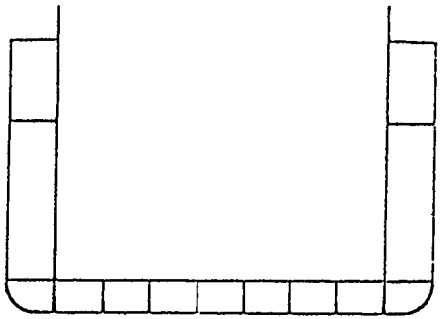
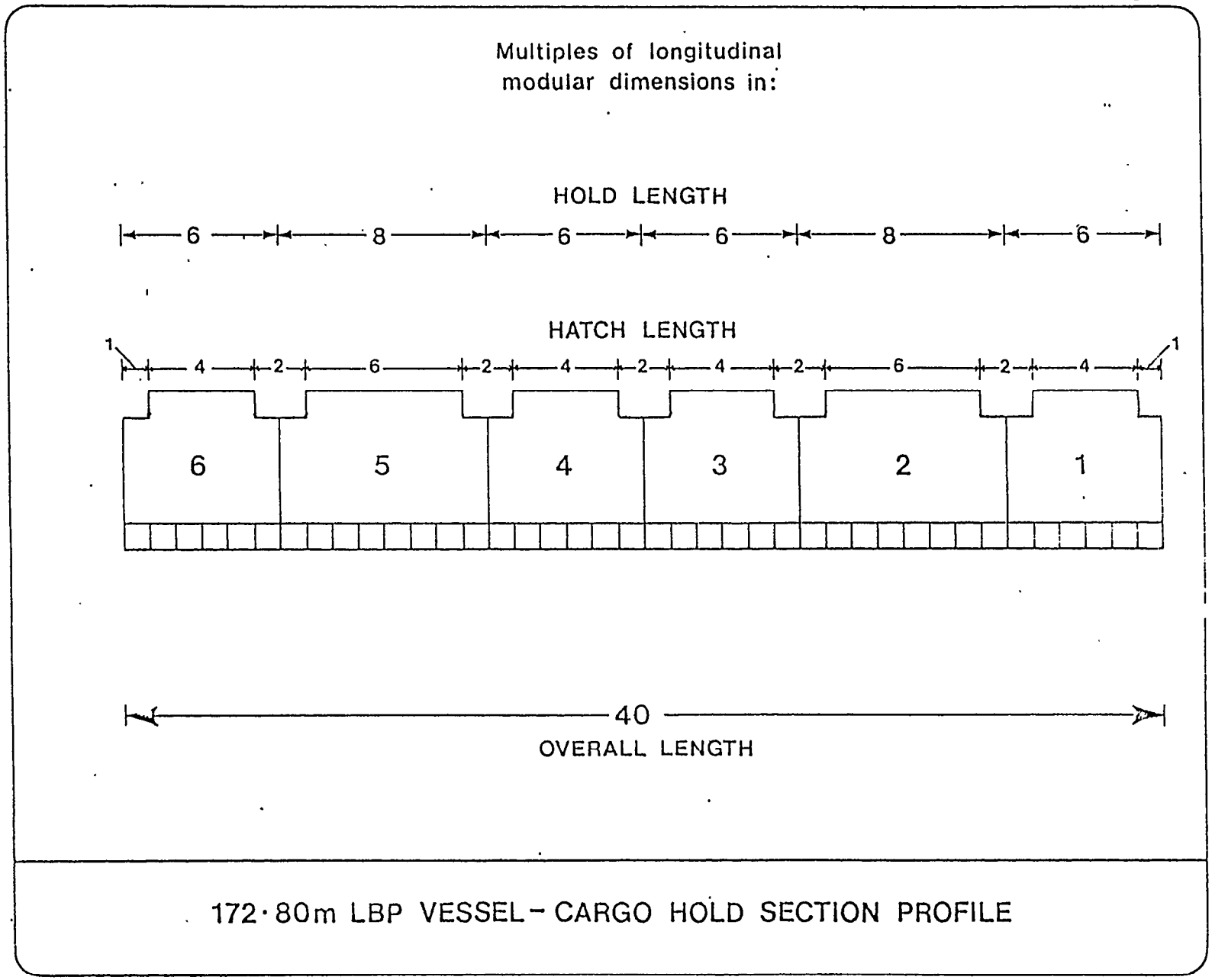


FOREST PRODUCTS

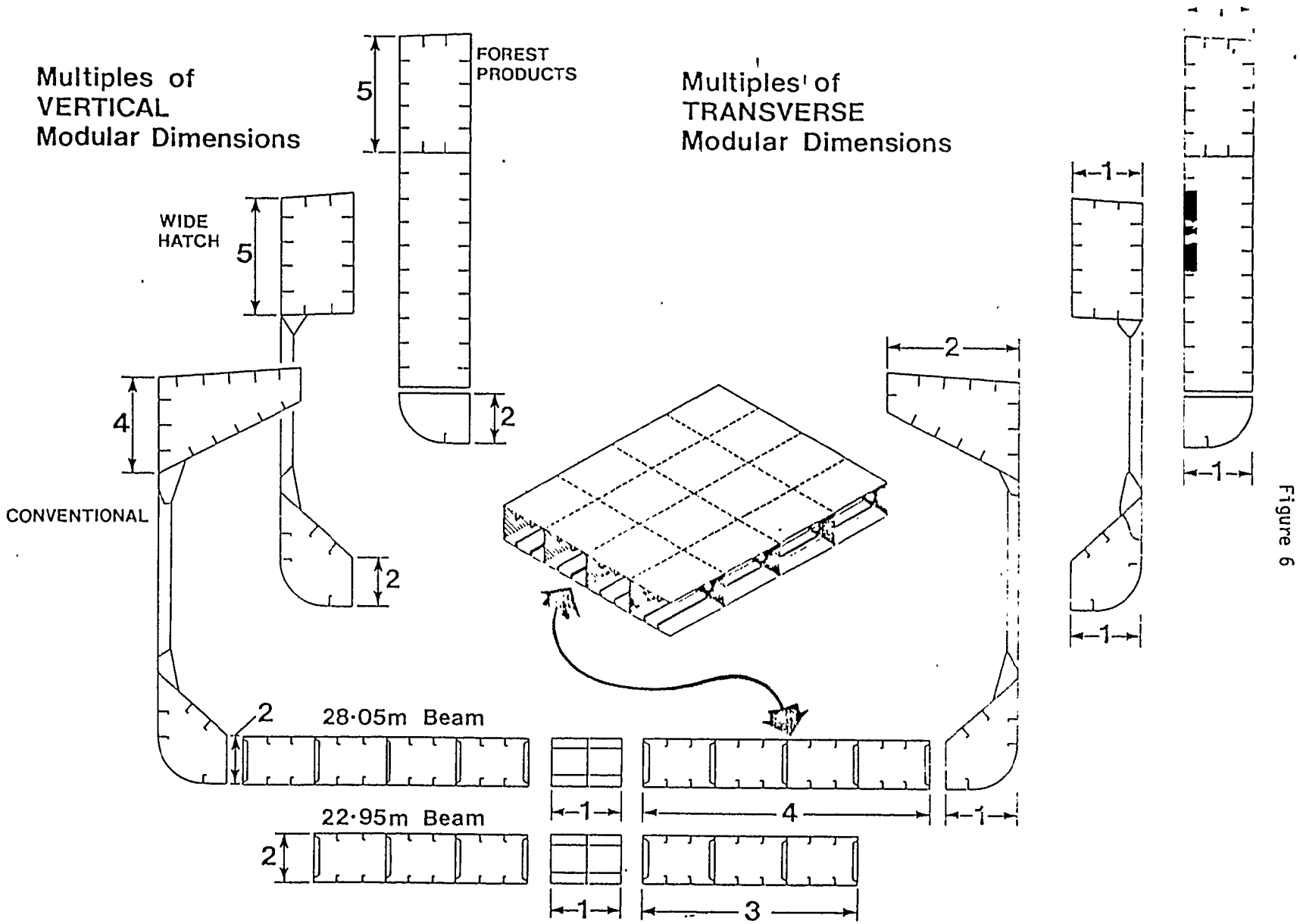
Beam & Type Options

Figure 4



172·80m LBP VESSEL – CARGO HOLD SECTION PROFILE

Figure 5



ALTERNATIVE MIDSHIP SECTIONS

Figure 6

Figure 7 .

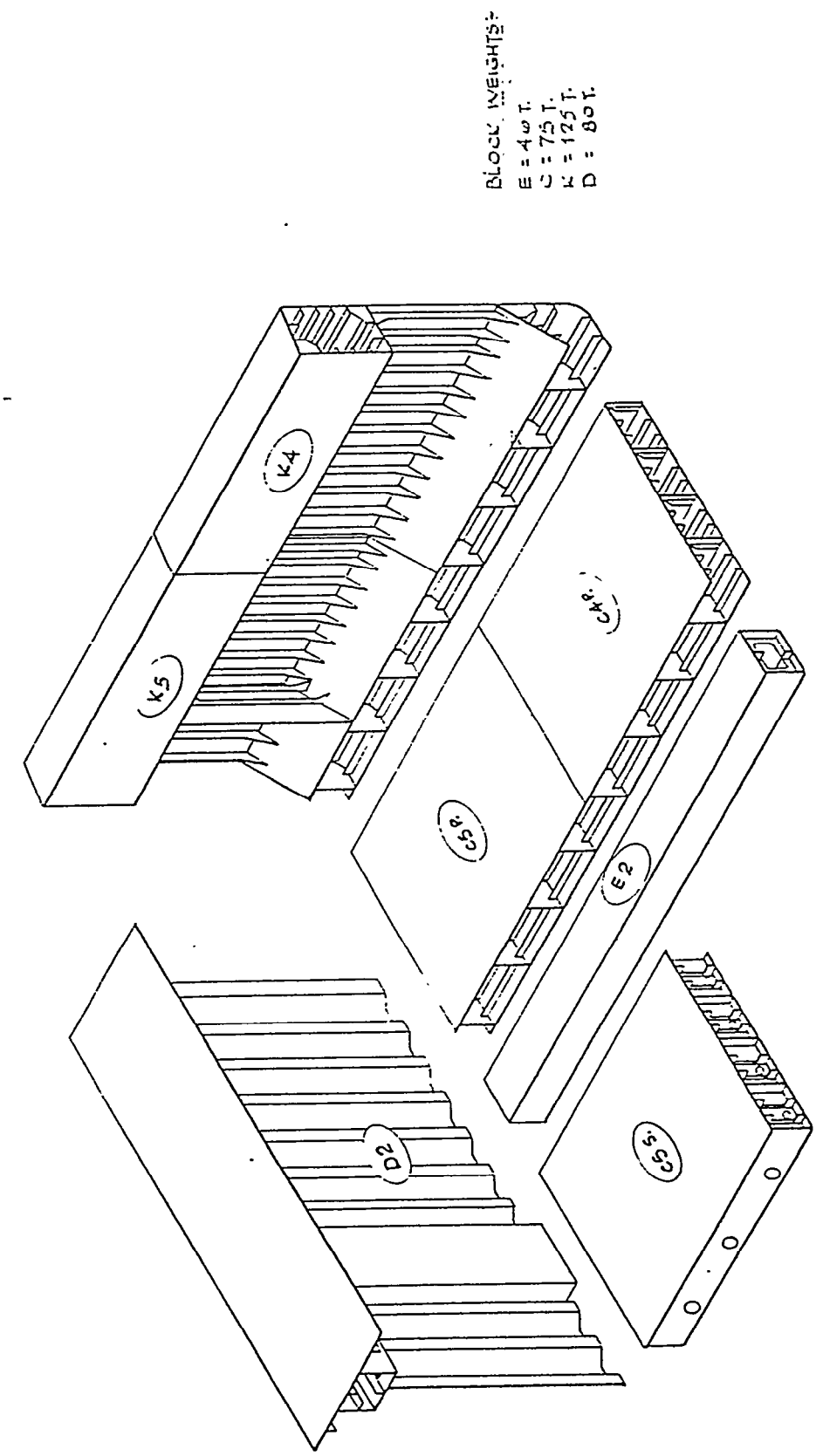
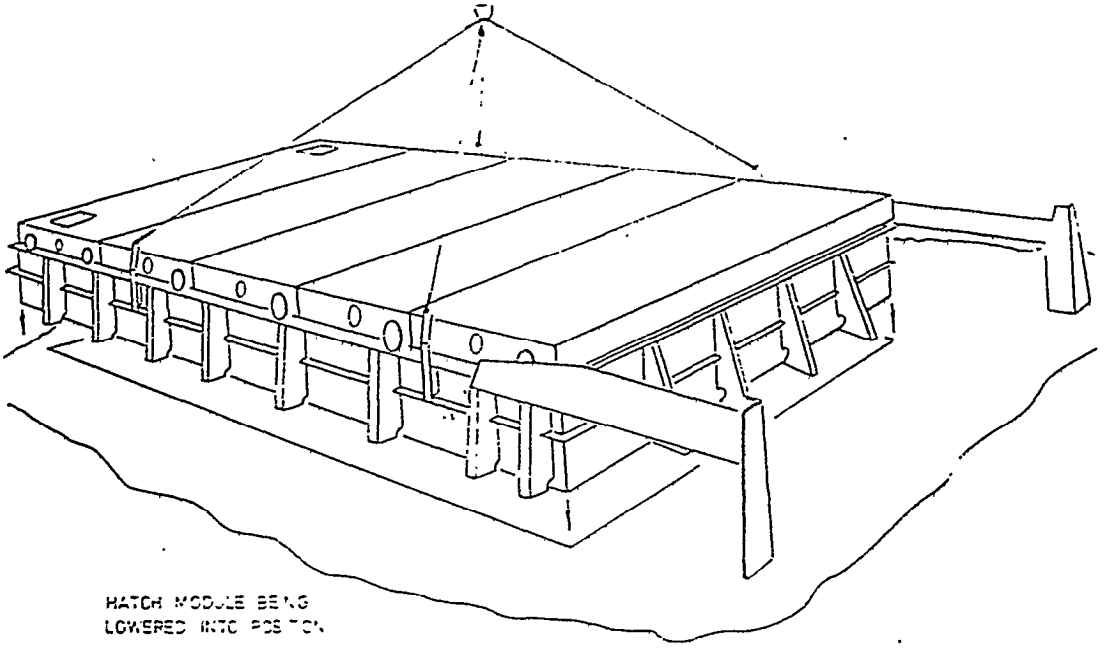
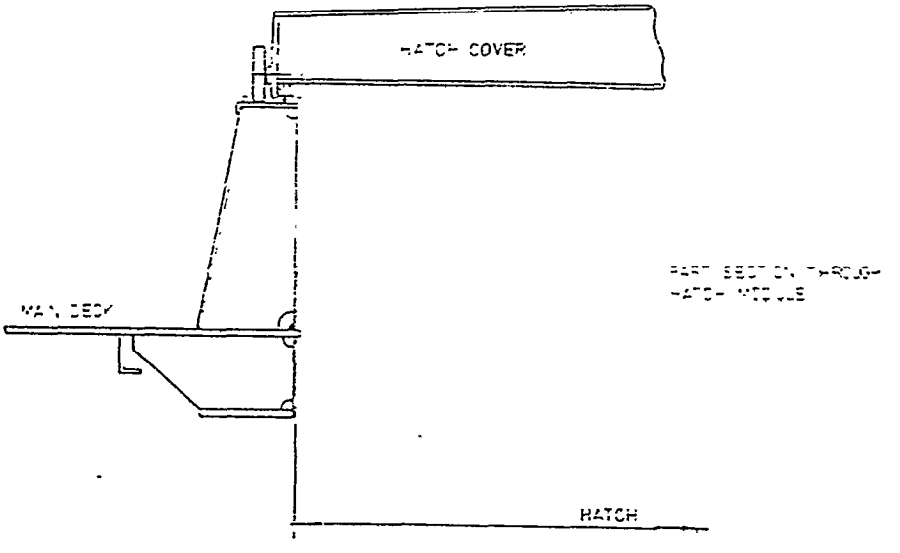


Figure 8



HATCH MODULE BEING
LOWERED INTO POSITION



HATCH MODULE

Hatch covers and coamings are assembled and tested 'off site' and delivered to the ship under construction.

Final Welding of the coamings is completed and module welded in position

Figure 9

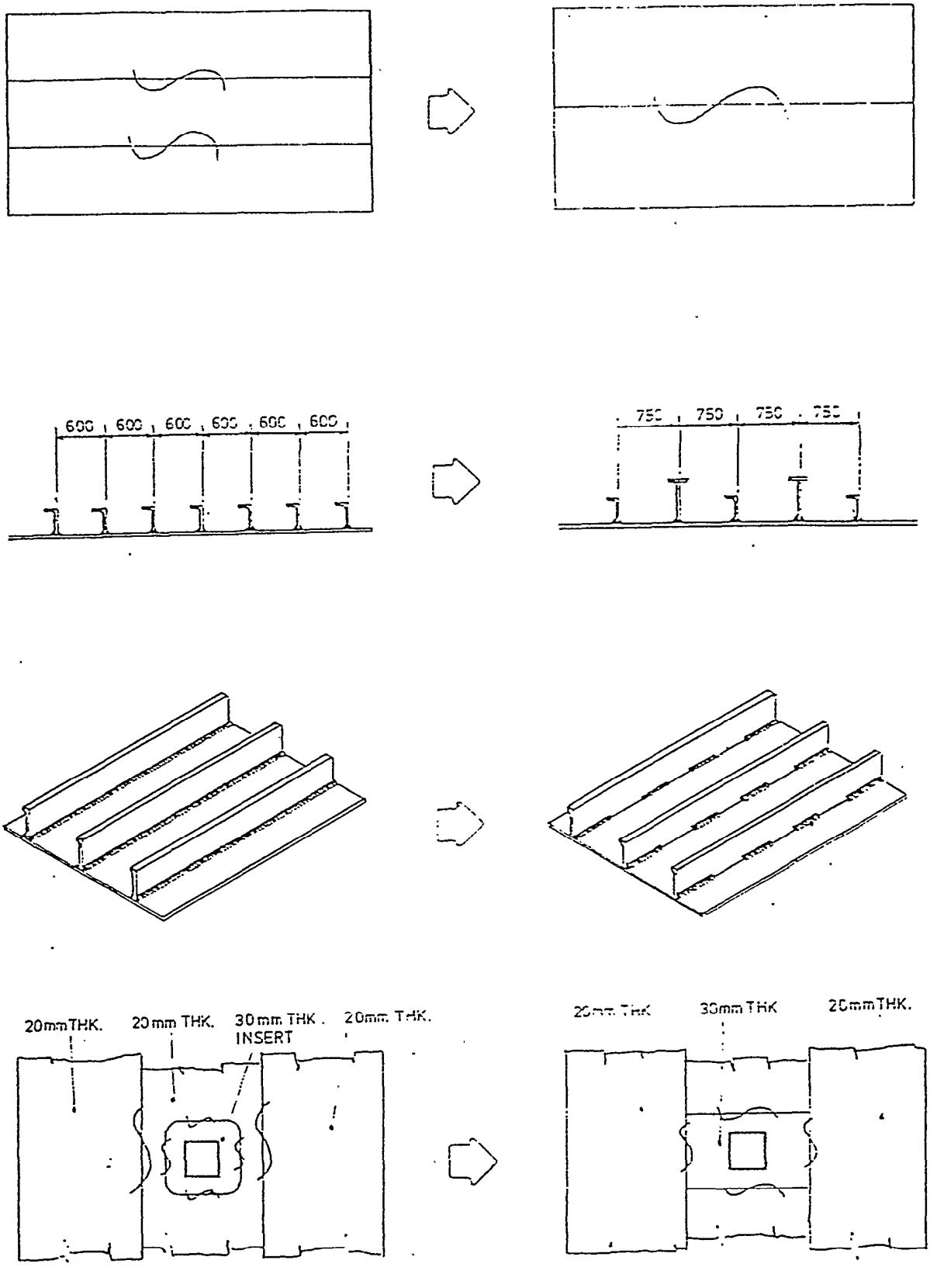
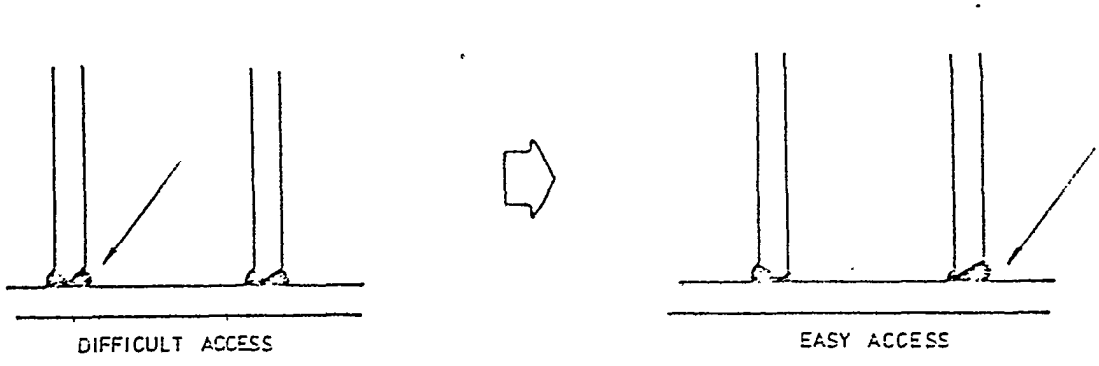
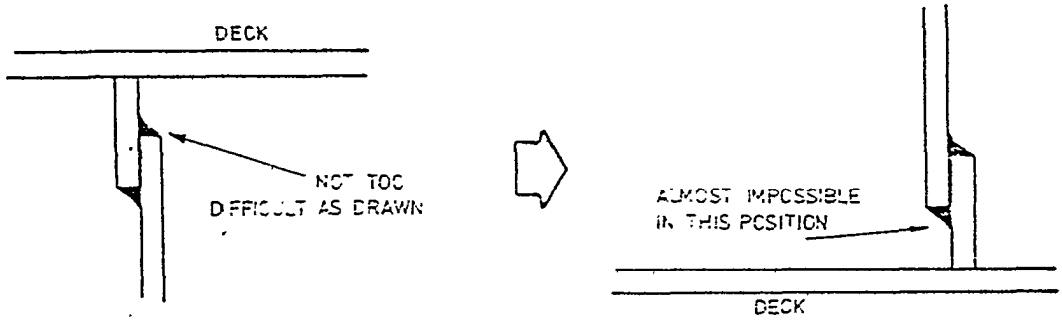

600
600
600
600
600
600
750
750
750
750
20mmTHK.
20mm THK.
30mm THK.
INSERT
20mm THK.
20mm THK
30mm THK
20mm THK.

Figure 10





PLATED RUDDER DETAIL

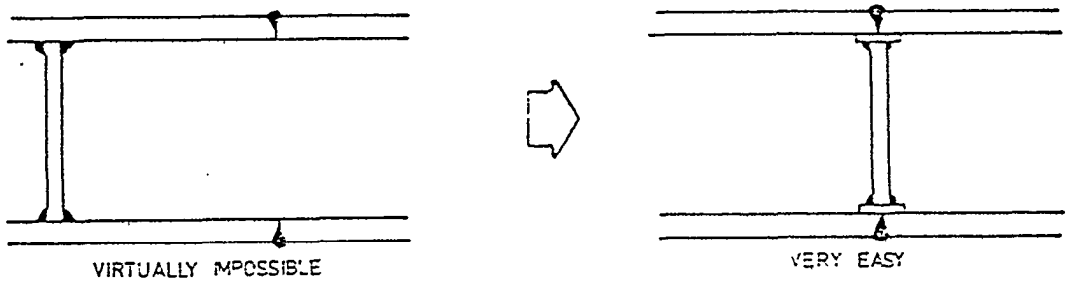


Figure 11

OPERATIONAL CHARACTERISTICS OF SHIPBUILDING

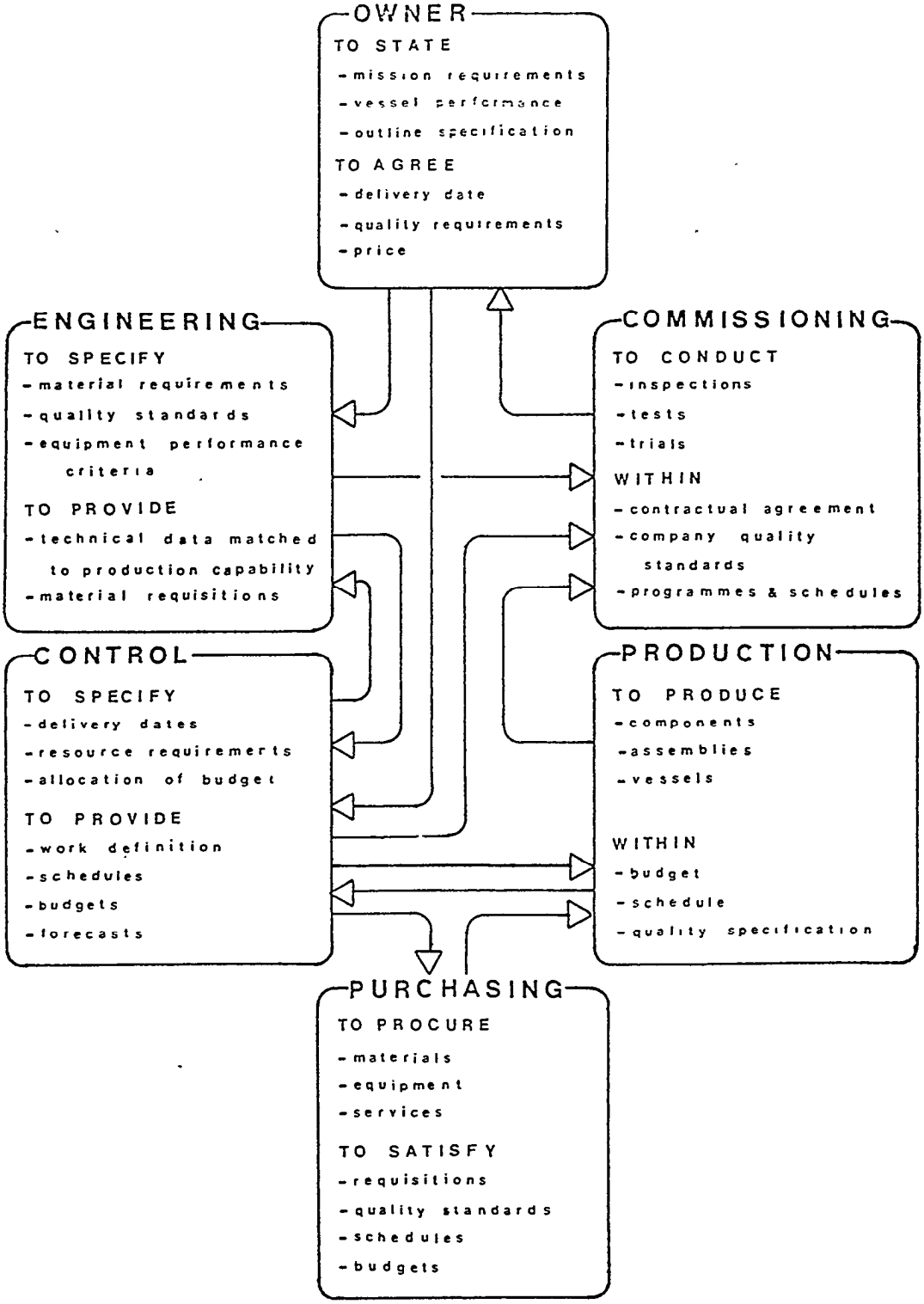


Figure 12

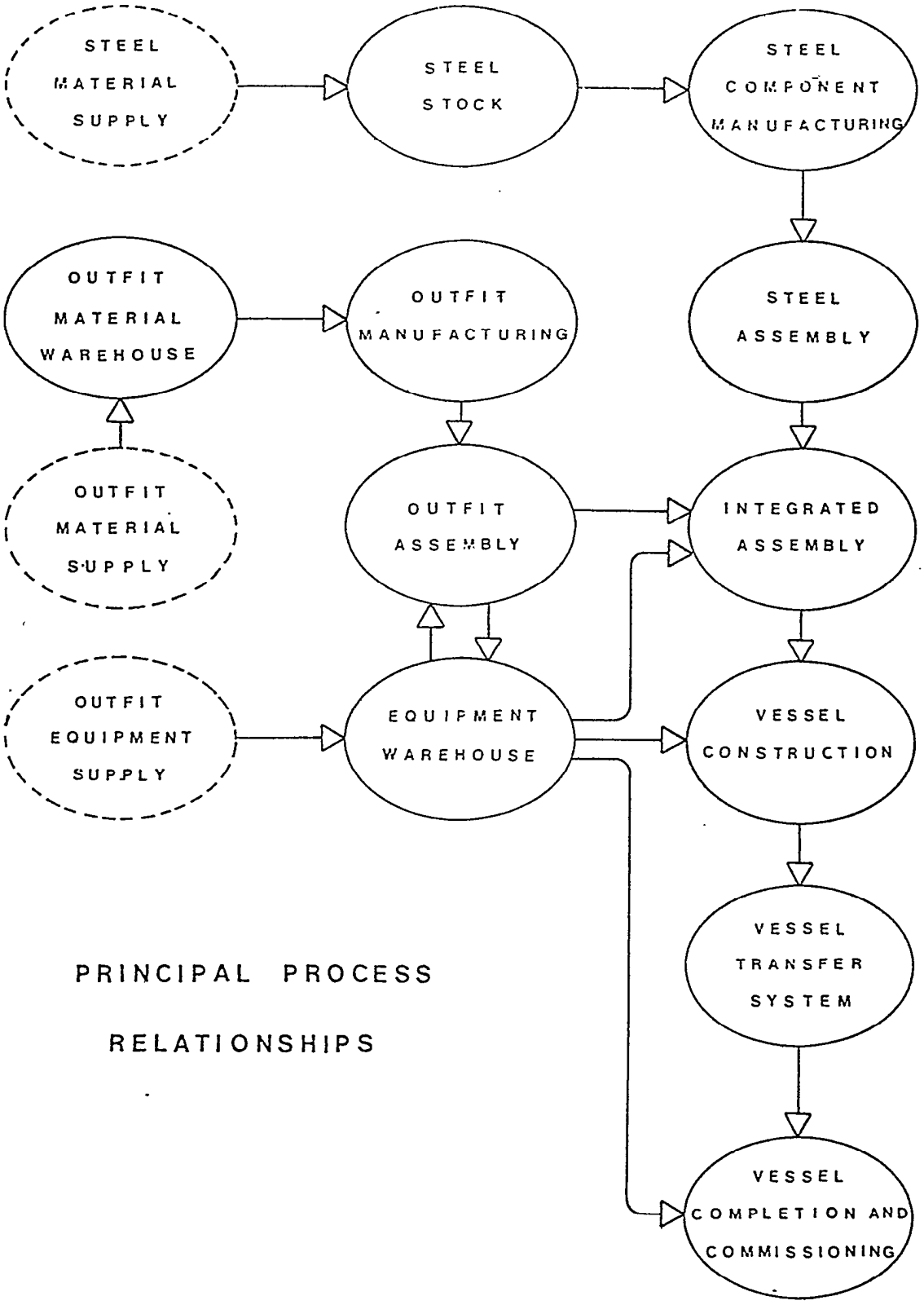

STEEL MATERIAL SUPPLY
STEEL STOCK
STEEL COMPONENT MANUFACTURING
OUTFIT MATERIAL WAREHOUSE
OUTFIT MANUFACTURING
STEEL ASSEMBLY
OUTFIT MATERIAL SUPPLY
OUTFIT ASSEMBLY
INTEGRATED ASSEMBLY
OUTFIT EQUIPMENT SUPPLY
EQUIPMENT WAREHOUSE
VESSEL CONSTRUCTION
VESSEL TRANSFER SYSTEM
VESSEL COMPLETION AND COMMISSIONING
PRINCIPAL PROCESS RELATIONSHIPS

Figure 13

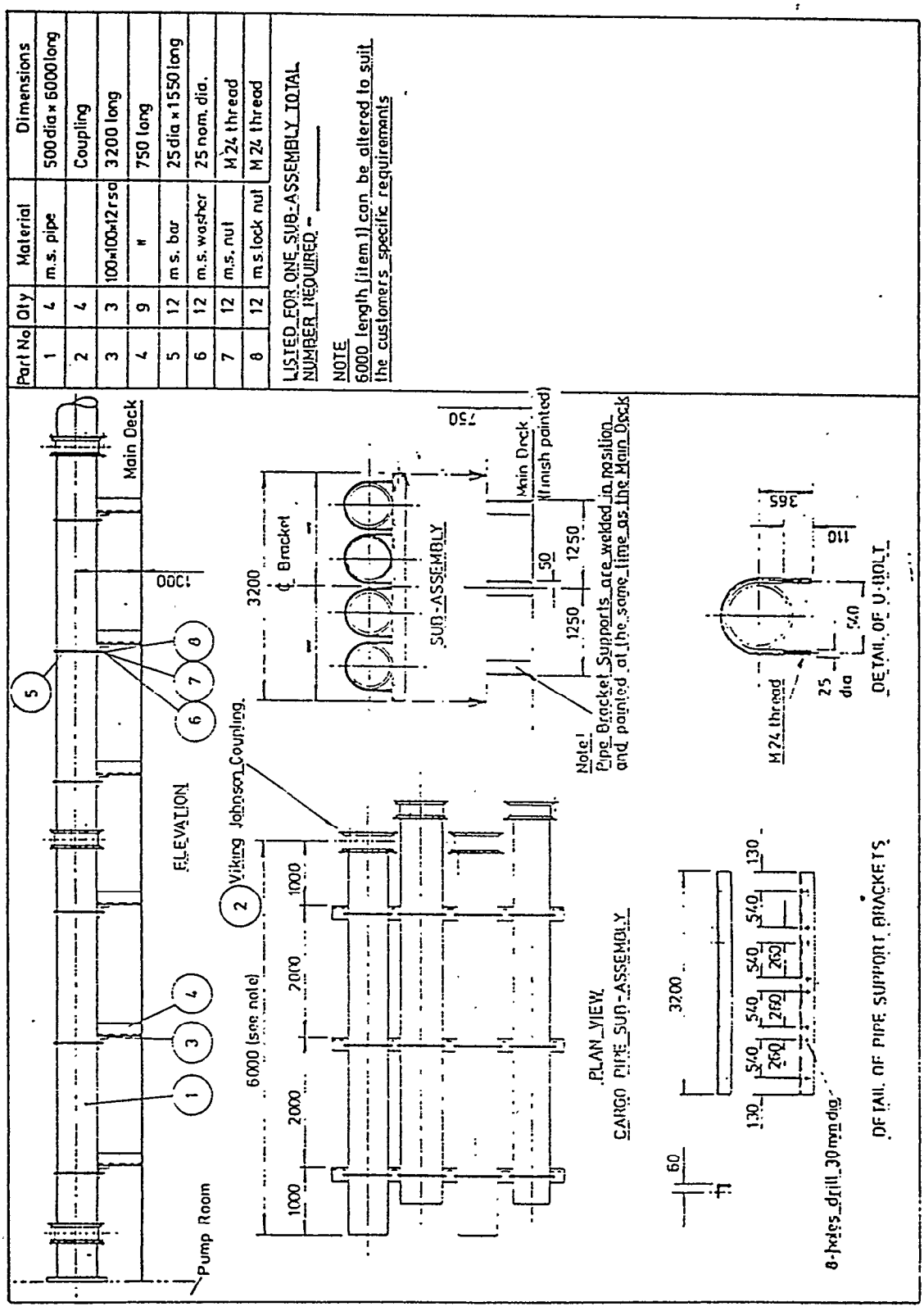

Part No | Qty | Material | Dimensions
1 | 4 | m.s. pipe | 500 dia x 6000 long
2 | 4 | | Coupling
3 | 3 | 100x100x12 rsa | 3200 long
4 | 9 | " | 750 long
5 | 12 | m.s. bar | 25 dia x 1550 long
6 | 12 | m.s. washer | 25 nom. dia.
7 | 12 | m.s. nut | M24 thread
8 | 12 | m.s. lock nut | M24 thread
LISTED FOR ONE SUB-ASSEMBLY TOTAL NUMBER REQUIRED - ____
NOTE
6000 length (item 1) can be altered to suit the customers specific requirements
Main Deck
Pump Room
ELEVATION
Viking Johnson Coupling
6000 (see note)
1000
2000
2000
1000
3200
℄ Bracket
SUB-ASSEMBLY
Main Deck
(Finish painted)
50
1250
1250
Note!
Pipe Bracket Supports are welded in position and painted at the same time as the Main Deck
PLAN VIEW
CARGO PIPE SUB-ASSEMBLY
3200
60
130
540
260
540
260
540
260
540
130
8-holes drill 30mm dia
M24 thread
365
110
25 dia
540
DETAIL OF U-BOLT
DETAIL OF PIPE SUPPORT BRACKETS

Figure 14

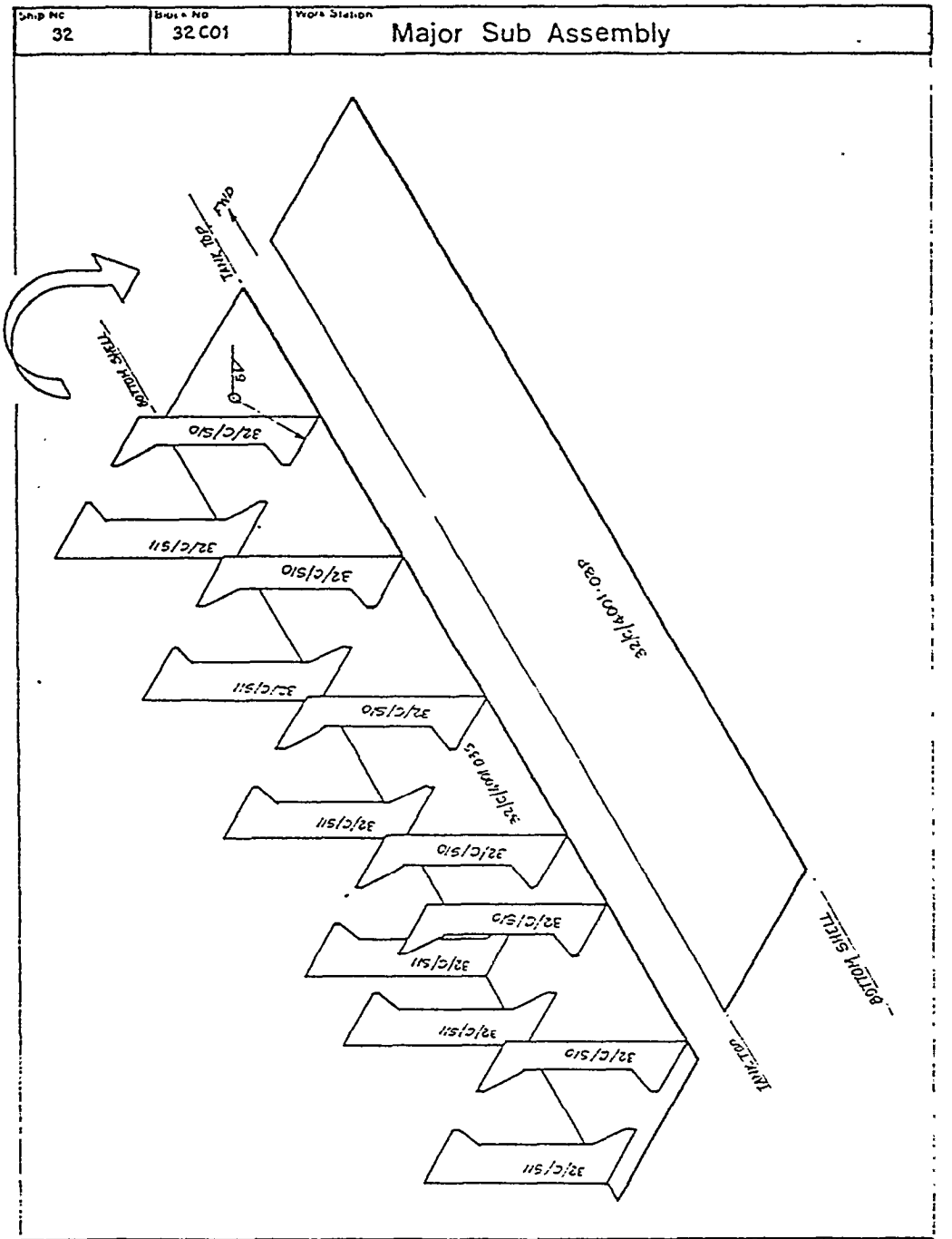

Ship No
32
Block No
32 C01
Work Station
Major Sub Assembly
Unit No
C013
Sub Assembly No
C/909
Description
DOUBLE BOTTOM CENTRE UNIT - DUCT KEEL
Weight
3·979T
Joint Length
Butt
Fillet
6000
Part No
C/S10
C/S11
Qty
6
6
Part No
Qty
Progress
UNIT ASSEMBLY

TABLE 1

DESIGN CONSIDERATIONS

a) Operational requirements study.

b) Principal dimensions selection.

c) Body plan.

d) Form variation.

e) Hydrostatic calculations.

f) Main dimensional analysis.

s) Freeboard.

h) Subdivision.

i) Propulsion system.

j) Capacity calculations.

k) Preliminary selection of equipment.

l) Machinery component selection.

m) Electrical component selection.

n) Weight and C.G. calculation.

0) Trim and stability calculation.

p) Damaged stability calculation.

q) Strength calculations.

r) Speed prediction.

S) General arrangements.

t) Machinery systems balance calculations.

u) General arrangement of engine room.

v) Pipe systems.

w) Electrical systems.

x) Technical specification.

TABLE 2

PRODUCIBILITY CONSIDERATIONS

a) Principal Dimensional Check

- Launch/float out.
- Navigation.
- Crane cover and clearance.
- Ground/dock loading.

b) Vessel Characteristics

- General arrangements.
- New/unknown type.
- Construction philosophy.
- Zone configuration.
- Special technological requirements.
- Structural configuration.
- Hull form.
- Supplier/subcontract content,
- Technical interdependence.
- Modularity and standards.
- Balance of work content.

c) Facility Characteristics

- Berth/dock dimensions.
- Tidal influence.
- Accessibility.
- Levels of technology employed.
- Human skills.
- Working practices.
- Resource balance.
- Manufactured products.

Table 2 cont'd

- Material storage.
- Crane capacities.
- Internal transport.
- Material dimensions.
- Standards.
- Production capacity.

d) Assembly Philosophy

- Steel.
- Outfit.
- Pipework.
- Engineering.
- Electrical.
- Subcontract content.
- Painting.
- Zone outfitting.
- Block breakdown.

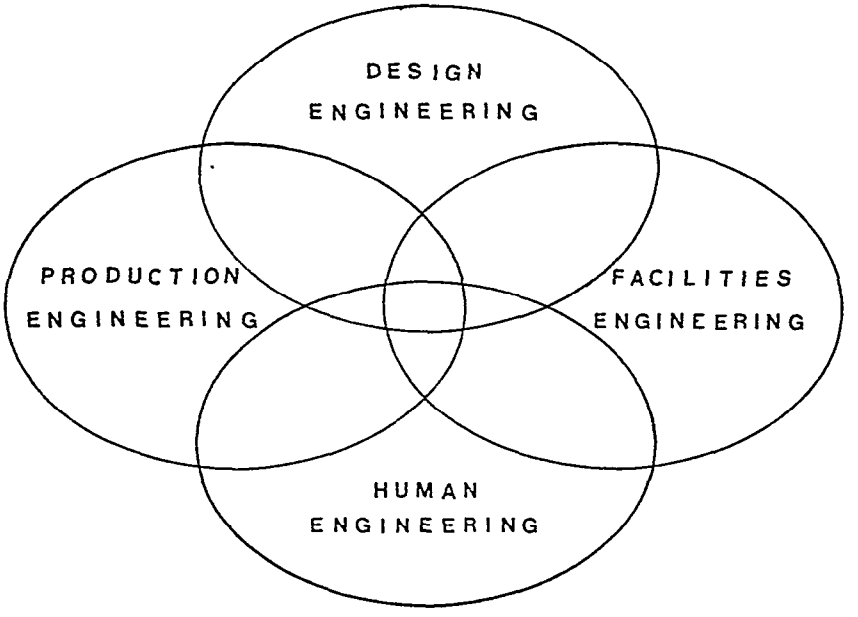
e) Manufacturing Philosophy

- Standards.
- Range of products.
- Modularity.
- Material definition.
- Jigs and tooling.
- Technical information.
- Balance of manufacturing resources.
- Subcontract content.

f) Planning and Control

- Programme and cost.
- Sequence of work.
- Work content analysis.
- Productivity.
- Sensitivity.

Figure 15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